इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 3915 (1966): Methods of Measurements on Audio Frequency Signal Generators (30 c/s to 30 kc/s) [LITD 8: Electronic Measuring Instruments, Systems and Accessories]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

(Reaffirmed 2000)

Indian Standard

METHODS OF MEASUREMENTS ON AUDIO FREQUENCY SIGNAL GENERATORS (30 c/s TO 30 kc/s)

(First Reprint FEBRUARY 1982)

UDC 621.373.029.4:621.317.3

© *Copyright* 1967

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

~~*Price Rs* 5·00~~ Gr 3

March 1967

Indian Standard

METHODS OF MEASUREMENTS ON AUDIO FREQUENCY SIGNAL GENERATORS (30 c/s TO 30 kc/s)

Electronic Equipment Sectional Committee, ETDC 24

Chairman	*Representing*
Shri S. Thiruvenkatachari	Directorate General of All India Radio (Ministry of Information & Broadcasting)
Members	
Research Engineer, AIR (*Alternate* to Shri S. Thiruvenkatachari)	
Shri K. M. Balchandani	Overseas Communications Service (Department of Communications)
Shri G. D. Gokarn (*Alternate*)	
Shri M. K. Basu	Wireless Planning & Co-ordination (Department of Communications)
Dr Saroj Datta	Directorate General of Civil Aviation (Department of Civil Aviation) (Ministry of Transport & Aviation)
Shri B. R. V. Vardan (*Alternate*)	
Shri P. N. Deobhakta	Directorate General of Technical Development (Ministry of Supply, Technical Development & Materials Planning)
Shri A. N. Mukherjee (*Alternate*)	
Deputy Director of Stores (Tech)	Naval Headquarters
Staff Officer Electrical Engineering (Standardization) (*Alternate*)	
Shri H. Joga Rao	State Broadcasting Department, Government of Andhra Pradesh, Hyderabad
Shri S. T. Kagali	Bharat Electronics Ltd, Bangalore
Shri K. S. Kelkar (*Alternate*)	
Shri R. S. Mundkur (*Alternate*)	
Shri M. N. Kekre	Police Wireless (Ministry of Home Affairs)
Wg Cdr J. S. Lamba	Directorate of Technical Development & Production (Air) (Ministry of Defence)
Wg Cdr S. Rao (*Alternate*)	
Col M. L. Midha	Directorate General of Inspection (Ministry of Defence)
Lt Col D. Swaroop (*Alternate*)	
Shri H. J. Mirchandani	Indian Telephone Industries Ltd, Bangalore
Shri S. D. Mani (*Alternate*)	

(*Continued on page* 2)

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

(*Continued from page* 1)

Members	*Representing*
Shri J. S. Monga	All India Radio Merchants' Association, Bombay
Shri V. J. Bhatt (*Alternate*) (Bombay)	
Shri D. N. Chaudhuri (*Alternate*) (Calcutta)	
Shri L. S. V. Easwar (*Alternate*) (Madras)	
Shri S. N. Mukerji	National Test House, Calcutta
Shri B. P. Ghosh (*Alternate*)	
Shri M. V. Namjoshi	All India Instrument Manufacturers' and Dealers' Association, Bombay
Shri N. Balasundaram (*Alternate*)	
Shri T. V. Ramamurti	Safety for Electronic Equipment Subcommittee, ETDC 24 : 3, ISI
Dr Ram Parshad	National Physical Laboratory (CSIR), New Delhi
Shri M. Sankaralingam	Directorate General of Supplies & Disposals (Ministry of Supply, Technical Development & Materials Planning)
Shri P. T. Krishnamachar (*Alternate*)	
Shri M. V. Shankar	Railway Board (Ministry of Railways)
Shri T. S. Subramanian	Directorate General of Posts and Telegraphs (Department of Communications)
Shri S. Venkataraman	Radio, Electronics and Television Manufacturers' Association (India), Calcutta
Shri S. C. Israni (*Alternate*)	
Shri Y. S. Venkateswaran, Director (Elec tech)	Director General, ISI (*Ex-officio Member*)

Secretaries

Shri S. Srinivasan
Director (Telecom), ISI
Shri N. Srinivasan
Deputy Director (Elec tech), ISI

Electronic Measuring Equipment Subcommittee, ETDC 24 : 2

Convener	
Kumari B. H. Shanta	Directorate General of Posts and Telegraphs (Department of Communications)
Members	
Shri N. Balasundaram	Eastern Electronics, Faridabad
Wg Cdr D. B. Das	Electrical and Electronic Test Measuring Instruments Standardization Panel (Ministry of Defence)
Maj A. G. Desai (*Alternate*)	
Shri S. K. Guha	Central Glass and Ceramic Research Institute (CSIR), Calcutta
Shri S. S. Madan	Philips India Ltd, Calcutta
Dr G. K. Mehta	Associated Instrument Manufacturers (India) Pvt Ltd, New Delhi
Shri N. Ganesan (*Alternate*)	

(*Continued on page* 10)

Indian Standard

METHODS OF MEASUREMENTS ON AUDIO FREQUENCY SIGNAL GENERATORS (30 c/s TO 30 kc/s)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 19 December 1966, after the draft finalized by the Electronic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard covers methods of measurements of (a) frequency; (b) output voltage; (c) hum, noise and distortion; and (d) source impedance, of audio frequency signal generators.

0.3 The methods of measurements included in this standard may be adopted for frequency ranges lower than 30 c/s or higher than 30 kc/s with suitable instruments and accessories.

0.3.1 The tests prescribed in this standard apply only to complete signal generators; separate consideration for the component parts has not been given in this standard.

0.4 This standard lays down a single method of measurement for each characteristic so as to achieve the required degree of precision. However, it is not intended to exclude other alternative methods of measurement for which necessary measuring equipment may be available and which are of equal or greater precision than the method prescribed in the standard.

0.5 The measurements of certain characteristics and calibration of the signal generator, which are temperature dependent, are to be carried out at or to be corrected to 27°C, which has been adopted as standard test temperature (*see* IS : 196-1966*). However, it is realized that certain limitations and practical difficulties exist at present, for adopting 27°C for signal generator. Hence till such time, facilities become available in the country for carrying out the measurements at 27°C for those characteristics for which the law of dependence is indeterminable, adoption of 20°C as the calibrating temperature may be permitted subject to agreement.

0.6 The requirements of various classes of audio frequency signal generators are proposed to be covered in a series of standards, the first among them being IS : 3886-1966†.

---

*Atmospheric conditions for testing (*revised*).

†Minimum requirements for general purpose audio frequency signal generators (30 c/s to 30 kc/s).

0.7 Methods of measurements for signal generators of frequency ranges higher than 30 kc/s, classified as radio frequency signal generators, are covered in IS : 2320-1963*.

0.8 In view of the fact that the information indicating the model designation, component location, power or current consumption, rated voltage and other significant particulars of the signal generator will be helpful in conducting measurements, it was felt desirable to include these details in Appendix A as information required by the testing authority.

0.9 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard lays down the conditions and detailed procedures for the tests to be conducted on audio frequency signal generators in the frequency range of 30 c/s to 30 kc/s, to determine their performance characteristics.

1.2 These tests apply to complete signal generators only and not to component parts thereof.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions and explanation of terms shall apply.

2.1 General

2.1.1 *Magnitude of Sinusoidal Voltages and Currents* — shall mean rms values, unless otherwise specified.

2.1.2 *Mains Operation* — Operation of the instrument from a power source with an operating voltage over 24 V, not solely used to supply power to the instrument.

2.2 Audio Frequency Signal Generator — Source of audio frequency voltage or power of accurately known characteristics.

2.3 Frequency

2.3.1 *Frequency Drift* — The variation in the frequency at the output of the signal generator after the end of the warm-up period, for a specified period of time, under constant operating conditions.

---

*Methods of measurements for amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s).

†Rules for rounding off numerical values (*revised*).

2.3.2 *Frequency Band* — Part of the entire frequency range within which continuous variation of frequencies is provided.

2.3.3 *Frequency Range* — The frequencies covered by a signal generator continuously in which the signals produced meet all the requirements specified in this standard.

2.4 Output Voltage — The rms value of the voltage at the output terminals of a signal generator *when terminated with the specified load impedance.*

2.4.1 *Residual Output Voltage* — The output voltage of the generator with all output controls turned to minimum position.

2.4.2 *Distortion Factor* — The ratio of rms voltage of all harmonics combined to the total rms value of the output voltage.

2.4.3 *Percentage Distortion* — Distortion factor expressed as a percentage.

2.5 Source Impedance — The impedance of the signal generator looking into it at the output terminals.

3. GENERAL CONDITIONS FOR MEASUREMENTS

3.0 Unless otherwise specified, measurements shall be made under normal measuring conditions as specified in **3.1** to **3.6**.

3.1 Normal Supply Voltage — Rated voltage shall be applied to the signal generator.

3.1.1 In case of ac mains operation, the voltage shall be applied at the rated frequency. The harmonic content of ac mains supply voltage shall not exceed 5·0 percent.

3.1.2 The supply voltage applied to the signal generator shall be held within ±2·0 percent of the rated value during the measurement of the characteristics.

3.1.3 In case of battery operation, primary or secondary batteries of the type and rated voltage as specified by the manufacturer, shall be used.

3.2 Termination — The signal generator shall be terminated with the specified load impedance.

3.3 Standard Atmospheric Conditions for Tests

3.3.1 All tests shall be carried out under the following atmospheric conditions:

Temperature	Between 15° and 35°C
Relative humidity	Between 45 and 75 percent
Atmospheric pressure	Between 860 and 1 060 mbar

3.3.1.1 Where the conditions mentioned above have a significant influence these shall be kept substantially constant during the tests.

3.3.2 If the temperature limits as given in **3.3.1** are too wide for certain tests, these tests shall be conducted or repeated in case of doubt, at a temperature of 27° ± 1°C and relative humidity of 65 ± 2 percent (*see* IS : 196-1966*) (*see also* **0.5**).

3.3.3 The signal generator shall be protected from draughts and direct radiations.

3.4 Measurements

3.4.1 Measurements shall be made at least at one point, preferably middle of each band.

3.4.2 All measurements shall be made after the initial warm-up period specified by the manufacturer.

3.5 Accuracy of Test Instruments — The test instruments employed to carry out measurements in accordance with this standard shall have an accuracy of at least one order higher than the specification of the apparatus against the quantity under measurement.

3.6 Reporting — The test report should clearly indicate the following:

a) Rated supply voltage,

b) Atmospheric conditions under which tests are carried out, and

c) Accuracy of test instruments.

4. FREQUENCY MEASUREMENTS

4.1 Frequency Calibration Error — The error in calibration of frequency dial readings of a signal generator shall be checked at least at three points on each band, the position being taken at the beginning, middle and end of each band. The frequencies should preferably be chosen from the series of preferred frequencies (*see* IS : 2264-1963†). The measurements shall be done at 27° ± 1°C. The frequency of the signal generator shall be measured using an electronic frequency counter as described in **4.1.1**.

4.1.1 *Measurement Using Electronic Frequency Counter* — The signal generator shall be terminated by its rated output impedance and the output from signal generator shall be fed to the input of the electronic frequency counter and the frequency read out directly.

4.2 Frequency Drift

4.2.1 Drift due to short-term operation shall be measured for any period corresponding to that specified for short-term drift taken at random after

---

*Atmospheric conditions for testing (*revised*).

†Preferred frequencies for acoustical measurements.

the initial warm-up period. The frequency drift is calculated by measuring the frequency of the signal generator before and after the chosen period in accordance with **4.1.1**. The supply voltage shall be kept constant within ± 1·0 percent and the ambient temperature at 27° ± 1°C.

4.2.2 Drift due to long-term operation shall be measured for any period corresponding to that specified for long-term drift, taken at random after the initial warm-up period. The frequency drift is calculated by measuring the frequency of the signal generator before and after the specified period in accordance with **4.1.1**. The supply voltage shall be kept constant within ± 1·0 percent and the ambient temperature at 27° ± 1°C.

4.3 Frequency Change Due to Temperature — The frequency shall be measured in accordance with **4.1.1** at different ambient temperatures at steps of 10°C over the specified operating range after thermal equilibrium is reached at each temperature. From these measurements the frequency change with temperature at various temperature steps shall be computed.

4.4 Frequency Change Due to ac Mains Voltage — In case of ac operated signal generators, the mains voltage shall be varied over the specified range of voltage in steps of 10 V. After maintaining the voltage at each step at least for 1 minute the frequency of the signal generator shall be measured by the method specified in **4.1.1**. The change in frequency due to mains voltage variation shall be computed from these measurements.

4.5 Frequency Change Due to Load Variation — The frequency of the signal generators shall be measured by the method specified in **4.1.1** under the following terminated conditions, with the output settings at maximum:

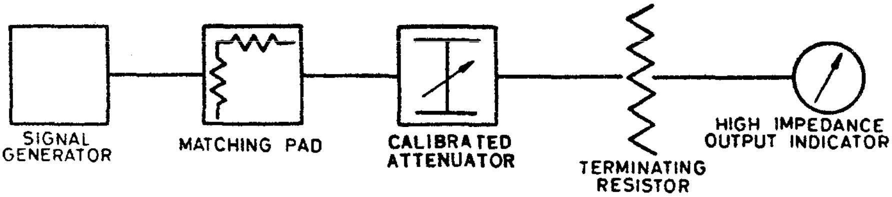
a) Rated output load,
b) Half rated output load, and
c) Open circuit.

4.5.1 The change in frequency due to load variation from rated output load to half rated output load and from rated output load to open circuit shall be computed from these measurements.

5. OUTPUT MEASUREMENTS

5.1 Measurement of Output Voltage — The output voltage measurements shall be carried out at 1 000 c/s.

5.1.1 *Direct Measurement of Output Voltage* — The output voltage may be measured directly with an electronic voltmeter having sufficiently high impedance. At lower outputs where a sufficiently accurate electronic voltmeter may not be available, a calibrated attenuator may be used as described in **5.1.2**.



NOTE — The matching pad need be provided only in cases where the attenuator impedance is not the same as the load impedance of the signal generator.

FIG. 1 SET-UP FOR MEASURING THE OUTPUT VOLTAGE WITH A CALIBRATED ATTENUATOR

5.1.2 *Measurement of Output Voltage with a Calibrated Attenuator* — The set-up shown in Fig. 1 may be used. With the output controls set at the maximum, the highest AF voltage shall be measured. Known attenuation is introduced with the help of the calibrated attenuator so that the output is the minimum calibrated output of the signal generator. The deflection D_1 on the output indicator shall be noted. The calibrated attenuator is then cut out and the output control of signal generator is adjusted so as to bring the deflection on the output indicator to D_1. The output control marking shall be noted against the calibrated attenuator marking. This calibration shall be repeated for various settings of the output control markings.

5.1.2.1 Readings corresponding to the change of position of output control of the signal generator obtained in terms of change of position of the external calibrated attenuator may be graphically represented so as to obtain a calibration chart for the output voltage of the signal generator.

5.2 Output Voltage Variation with Frequency — The signal generator shall be terminated by the specified load impedance. The output control of signal generator shall be adjusted to a convenient reference level which shall be measured by means of an electronic voltmeter. With the output control setting kept constant, the frequency of the signal generator shall be varied over the specified frequency range (from lowest to highest) and the output voltage measured at suitable number of frequencies. The output voltage, thus measured, shall be plotted as a function of frequency to give the frequency response of the signal generator.

5.3 Output Voltage Variation Due to Temperature — The output voltage shall be measured in accordance with **5.1** at different ambient temperatures in steps of 10° C over the specified operating temperature range after thermal equilibrium is reached at each temperature. From these measurements, the output voltage variation with temperature shall be computed.

5.4 Output Voltage Variation Due to ac Mains Voltage Variation — In case of ac operated signal generator, the mains voltage shall be varied over the specified range of supply voltage in steps of 10 V and the output voltage measured in accordance with **5.1** after maintaining the supply voltage at each step for a period of 1 minute. The change in output voltage due to mains voltage variation shall be computed from these measurements.

5.5 Common Mode Rejection (for Balanced Output Only) — The measurement of common mode rejection in the case of signal generators with a balanced output is done by measuring the output voltage of the virtual central point of the output terminals with reference to ground and comparing it with the output voltage of the signal generator at the same output setting.

5.5.1 This measurement may be carried out by using a set-up (*see* Fig. 2) consisting of an output indicator, change-over switch and resistor consisting of two matched units, with a degree of matching of at least 80 dB; each unit being equal to half the specified load impedance of the signal generator.

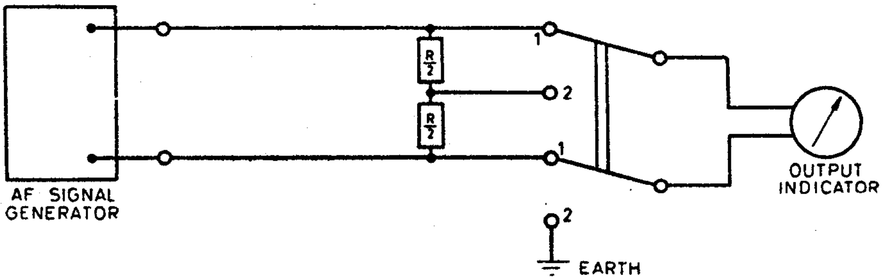


FIG. 2 SET-UP FOR MEASURING COMMON MODE REJECTION

5.5.2 The output of the signal generator is first measured on the output indicator. The change-over switch is then thrown to position 2 and the output of the virtual centre point with respect to ground is measured.

5.5.3 The ratio of the two readings expressed in dB gives the common mode rejection at the output terminals.

5.5.4 These readings are repeated at three different settings of the frequency, namely maximum, mean and minimum of the signal generator, and three different settings of the output control, namely maximum, mean and minimum.

6. HUM, NOISE AND DISTORTION MEASUREMENTS

6.1 The output of the signal generators, with the output controls set at a specified level shall be applied to a distortion factor meter and the total hum, noise and distortion shall be read directly.

7. SOURCE IMPEDANCE MEASUREMENTS

7.1 The open circuit voltage of the signal generator shall be measured with the help of an electronic voltmeter having an impedance, at least 1 000 times higher than the impedance of the signal generator under test. The signal generator shall then be terminated with a variable resistance and the value of the resistance is adjusted such that the output voltage read on the electronic voltmeter is half of the open circuit voltage. This value of the resistance in ohms is stated as the source impedance of the signal generator.

7.1.1 The measurement shall be repeated at different settings of the output controls of the signal generator.

APPENDIX A

(*Clause* 0.8)

INFORMATION REQUIRED BY TESTING AUTHORITY

A-1. The following is the minimum information required by the testing authority for carrying out measurements in accordance with this standard:

a) Serial number and model designation of the signal generator,

b) Name and trade-mark of the manufacturer,

c) Type of power supply and the operating voltage,

d) Maximum power consumption in the case of mains-operated signal generators or maximum current range in the case of battery-operated signal generators,

e) Plan of the chassis showing the location of the component, and

f) Any other information or caution which the manufacturer may consider necessary.

(*Continued from page* 2)

Members	*Representing*
Shri J. S. Monga	Radiola Corporation, New Delhi
Shri R. S. Mundkur	Bharat Electronics Ltd, Bangalore
Shri D. V. S. Raju	Electronic & Industrial Instruments Co Pvt Ltd, Hyderabad
Shri V. R. Bhat (*Alternate*)	
Dr Ram Parshad	National Physical Laboratory (CSIR), New Delhi
Shri T. N. Ghosh (*Alternate*)	
Shri C. S. Rangan	National Aeronautical Laboratory (CSIR), Bangalore
Shri T. V. A. Subramanian	Atomic Energy Establishment, Trombay, Bombay
Lt-Col D. Swaroop	Directorate General of Inspection (Ministry of Defence)
Shri K. V. Ramamurthy (*Alternate*)	
Shri P. K. Venkatasubramanian	Directorate General of All India Radio (Ministry of Information & Broadcasting)

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 1 kg.1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones : 26 60 21, 27 01 31 **Telegrams : Manaksanstha**

Regional Offices:

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	23-08 02
Southern : C. I. T. Campus, Adyar	MADRAS 600020	41 24 42

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	2 76 49
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
Ahimsa Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 83 20
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
D-277 Todarmal Marg, Banipark	JAIPUR 302006	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	8 12 72
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27

Reproduced by Reprography Unit, ISI, New Delhi